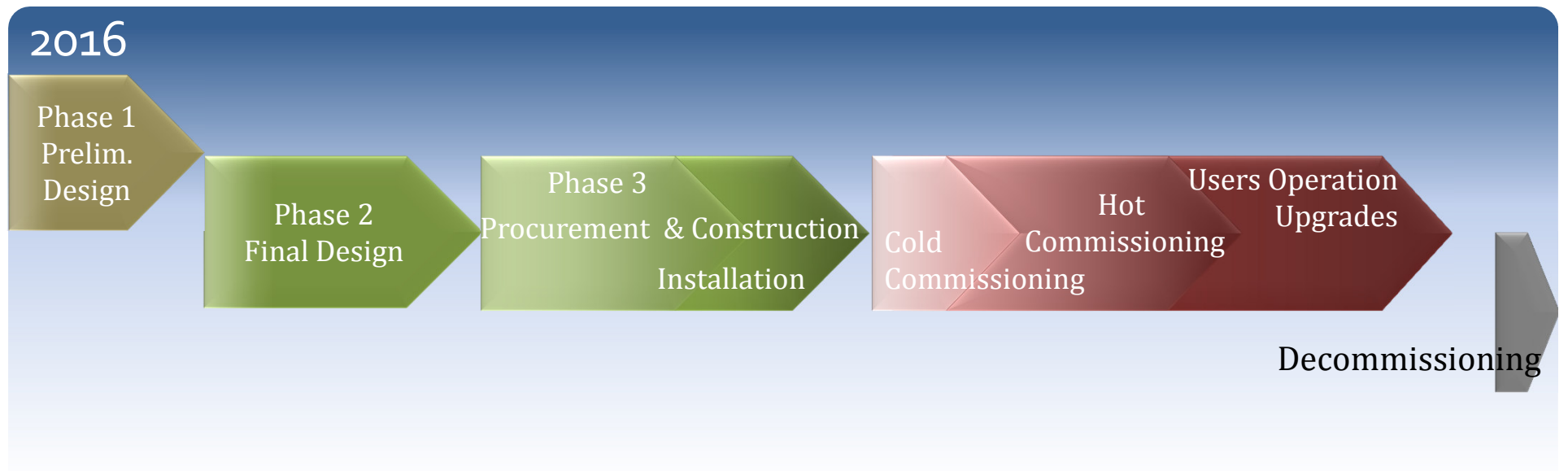
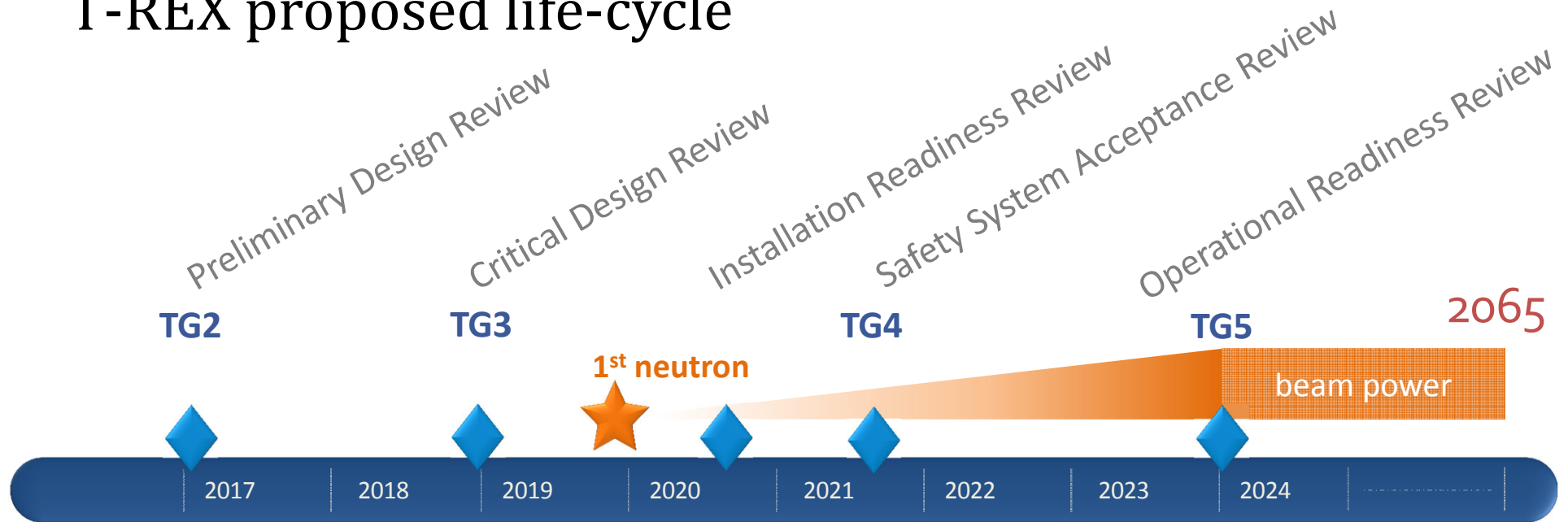


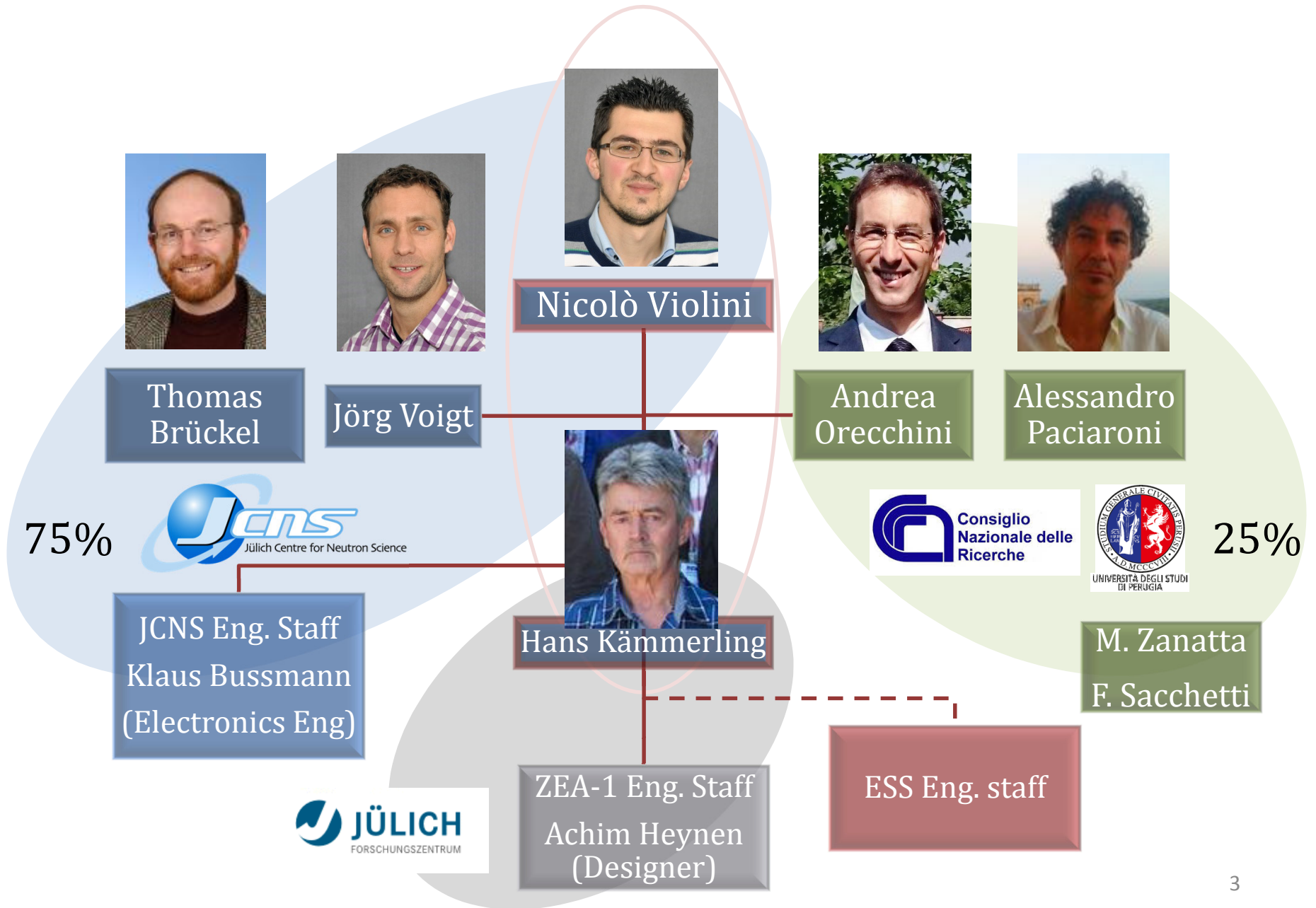
## PROJECT TIMELINE

1. Proposed life cycle
2. Resources
3. IK partnership
4. Labor Value
5. Critical dates

# T-REX proposed life-cycle

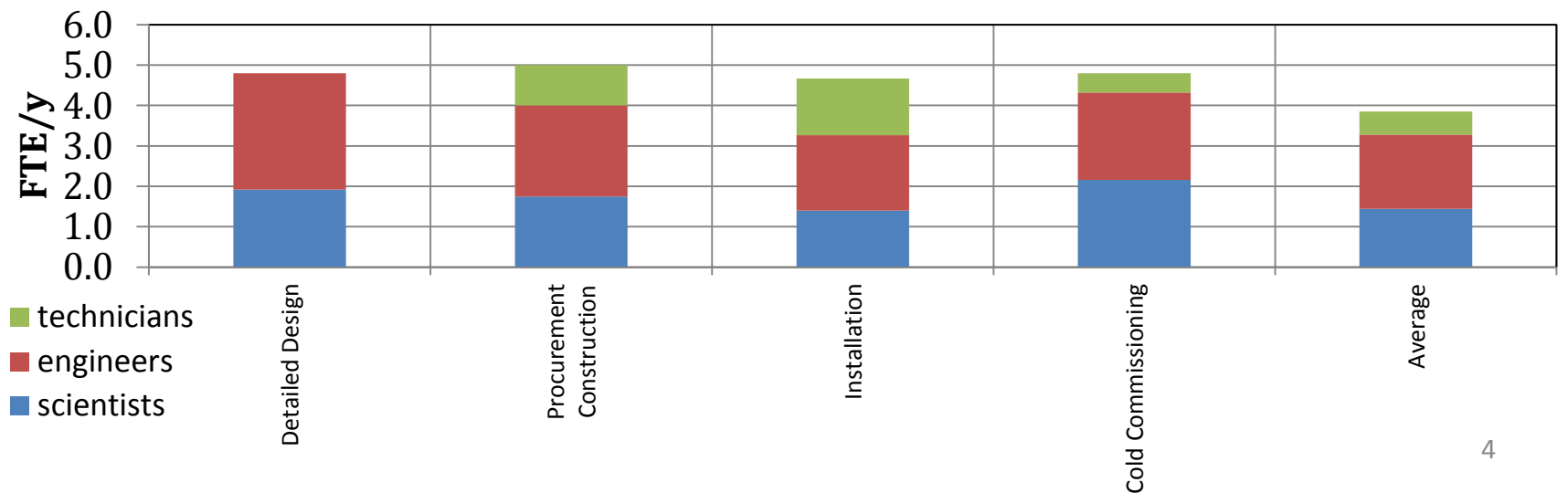


# T-REX Instrument Team



# Labor distribution

	Phase 2	Phase 3a	Phase 3b	Phase 4	
	Detailed Design	Procurement Construction	Installation	Cold Commissioning	TOTAL
Duration years	1.7	1	1.5	0.8	5
%	33	20	30	17	100%
Tasks [y]	8	5	7	4	24
Scientists	1.9	1.8	1.4	2.2	
Engineers	2.9	2.3	1.9	2.2	
Technicians		1.0	1.4	0.5	



# Labor value

	cat	load [%]	period [months]	TOTAL
Lead Scientist	D	100	60	€ 693000
Lead Engineer	D	100	60	€ 693000
JCNS Advisor Scientist	D	30	60	€ 207900
JCNS Designer	C	100	48	€ 432000
JCNS MCA	C	100	21	€ 189000
CNR Advisor Scientist	D	20	60	€ 138600
CNR Advisor Scientist	C	20	60	€ 108000
CNR Scientist	C	20	60	€ 108000
CNR Engineer	C	10	60	€ 54000
CNR Technician/Designer	B	75	60	€ 324000
CNR Admin	A	5	60	€ 18000
ESS Installation	B	100	24	€ 172800
ESS procurement (*)	C	100	3	€ 27000
Travel				€ 147600
FZJ share				75%
CNR share				25%
phase 2-3-4-5				€ 3312900
phase 1				€ 397650
TOTAL				€ 3710550

# Critical dates of T-REX project

## Detector Vessel

Q2/2017 Preliminary Engineering design and interfaces

Q4/2017 Decision on the detector technology

Q1/2018 Final design

Q2/2020 Delivery

Q4/2020 Commissioning

## Detectors

Q2/2017 MG prototype available for tests

Q1/2018 engineering design

## Choppers

Q1/2018 engineering design

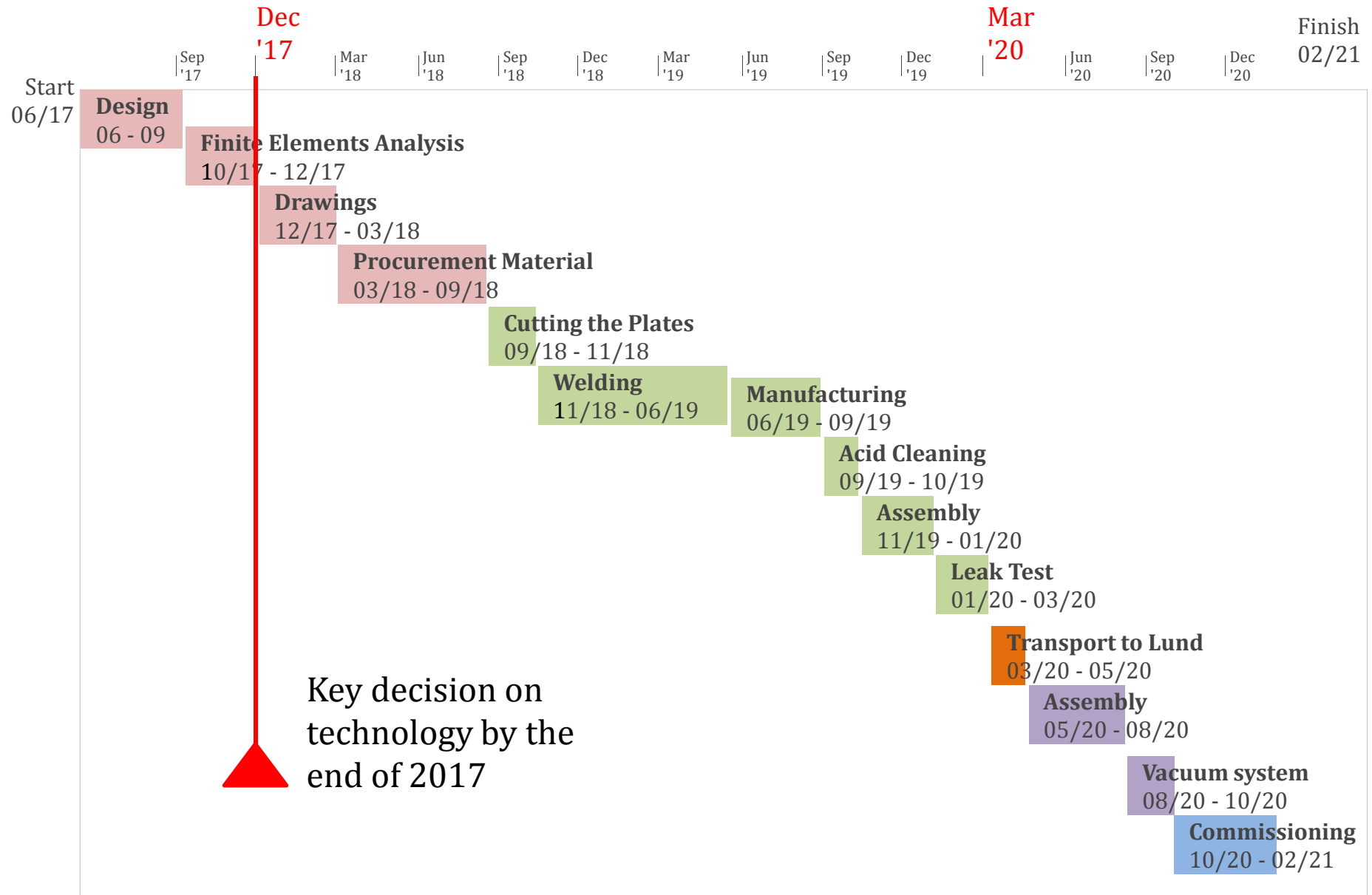
Q1/2018 contract signed

## Neutron Optics & Shielding

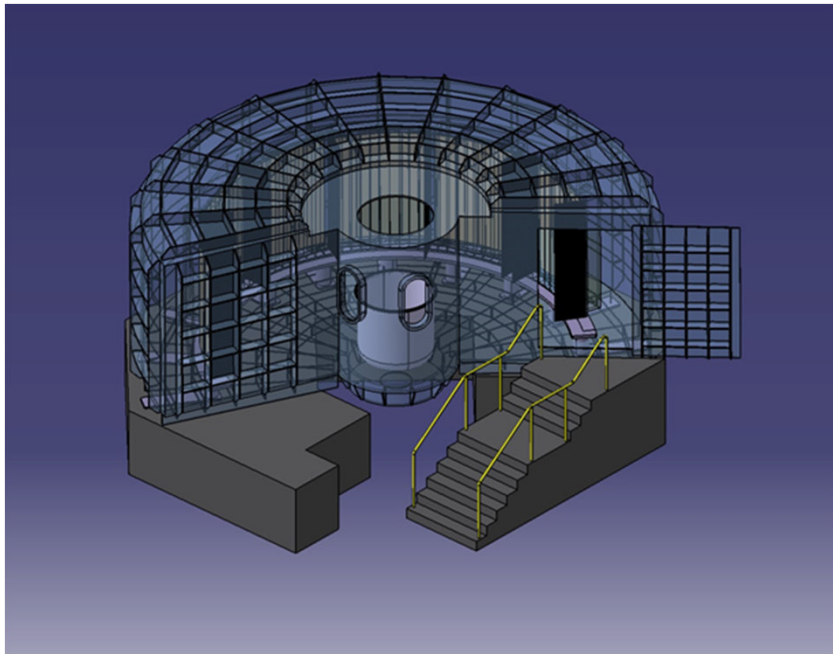
Q3/2018 engineering design

Q2/2019 contract signed

# Timeline Detectors : Detector Vessel (FZJ / ZEA-1)



# Detector Vessel : Cost vs Experience



	<b>T -REX</b>	<b>TOPAS</b>
Material	Stainless steel	Stainless steel
Vacuum	$< 10^{-5}$ mbar	$< 10^{-5}$ mbar
Height	3250 mm	3200 mm
Diameter	8500 mm	6500 mm
Volume	85 m <sup>3</sup>	75 m <sup>3</sup>
Horizontal det. angles	-36° - 144°	-30° - 140°

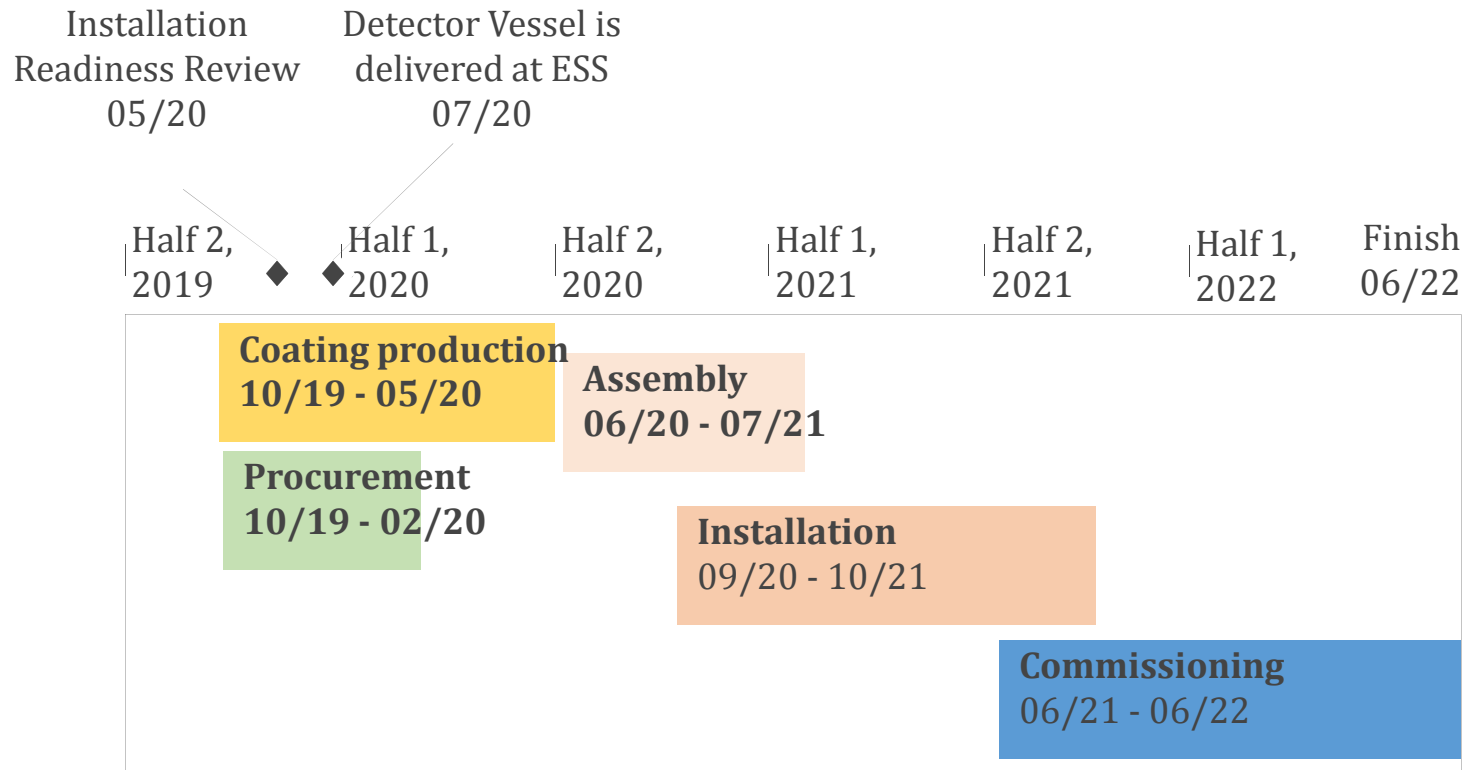


# Detector Vessel : Cost vs Experience

Components	Cost
<b>Vacuum chamber</b>	
FEM calculations	10.000.00 €
Semi-finished stainless steel sheets	480.000.00 €
Water jet cutting plates	61.000.00 €
Rolling the outer plates	13.000.00 €
Transports	10.000.00 €
Welding of the chamber	160.000.00 €
Pickling the chamber	4.000.00 €
Mechanical Manufacture	185.000.00 €
Assembly	12.000.00 €
Leakage test	4.000.00 €
	<b>939.000.00 €</b>
<b>Sample chamber</b>	
Semi-finished products	20.000.00 €
Production	65.000.00 €
Purchases	7.000.00 €
	<b>92.000.00 €</b>
Cd shielding	<b>32.000.00 €</b>
Al structural frames for shielding + assembly	<b>47.000.00 €</b>
Load lock system	<b>50.000.00 €</b>
<b>TOTAL</b>	<b>1.160.000.00 €</b>

C-SPEC chamber  
has been quoted  
1626k€  
Including radial  
collimator and  
man power

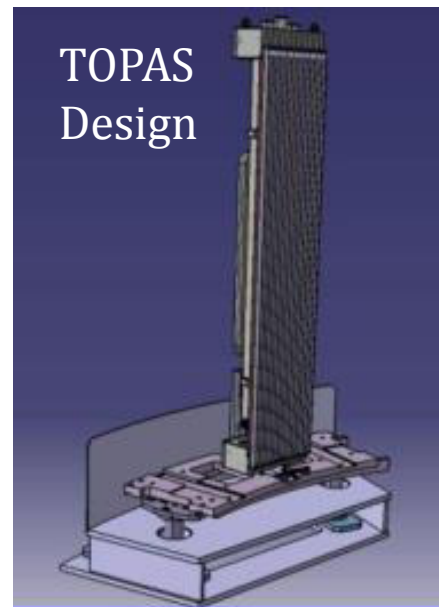
# Timeline Detectors : MG production (ESS)



# Detectors technologies

T-REX needs  $20 \text{ m}^2$   
pixels  $< 20 \times 20 \text{ mm}^2$

	Pros / Advantages	Cost
$^3\text{He}$ PSD tubes	Benchmark Off-the-shelf Vacuum operation	7,2 M€



# Detectors technologies

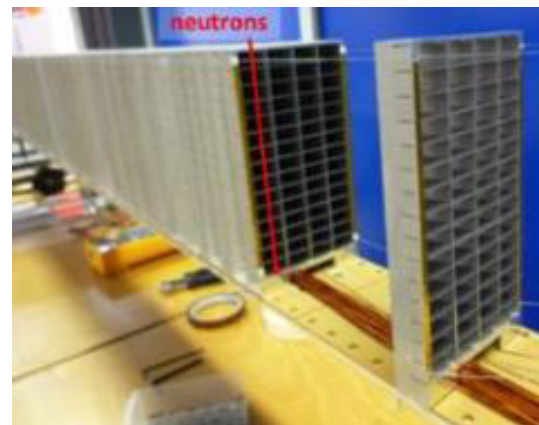
T-REX needs  $20 \text{ m}^2$   
pixels  $< 20 \times 20 \text{ mm}^2$



	Pros / Advantages	Cost
$^3\text{He}$ PSD tubes	Benchmark Off-the-shelf Vacuum operation	7,2 M€
Multi GRID	Cost Detection Rate Modularity	4,6 M€

20-24  $^{10}\text{B}_4\text{C}$  layers  
to reach 45-48% efficiency @  $1\text{\AA}$   
Fairly compares to  $^3\text{He}$  at 6 bar

+3% efficiency = +10% of cost



# Detectors technologies

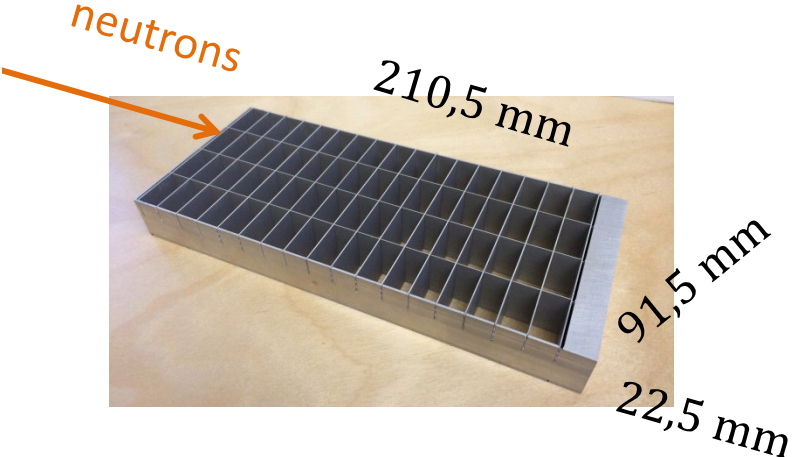


Multi GRID	Cost Detection Rate Modularity	4,6 M€
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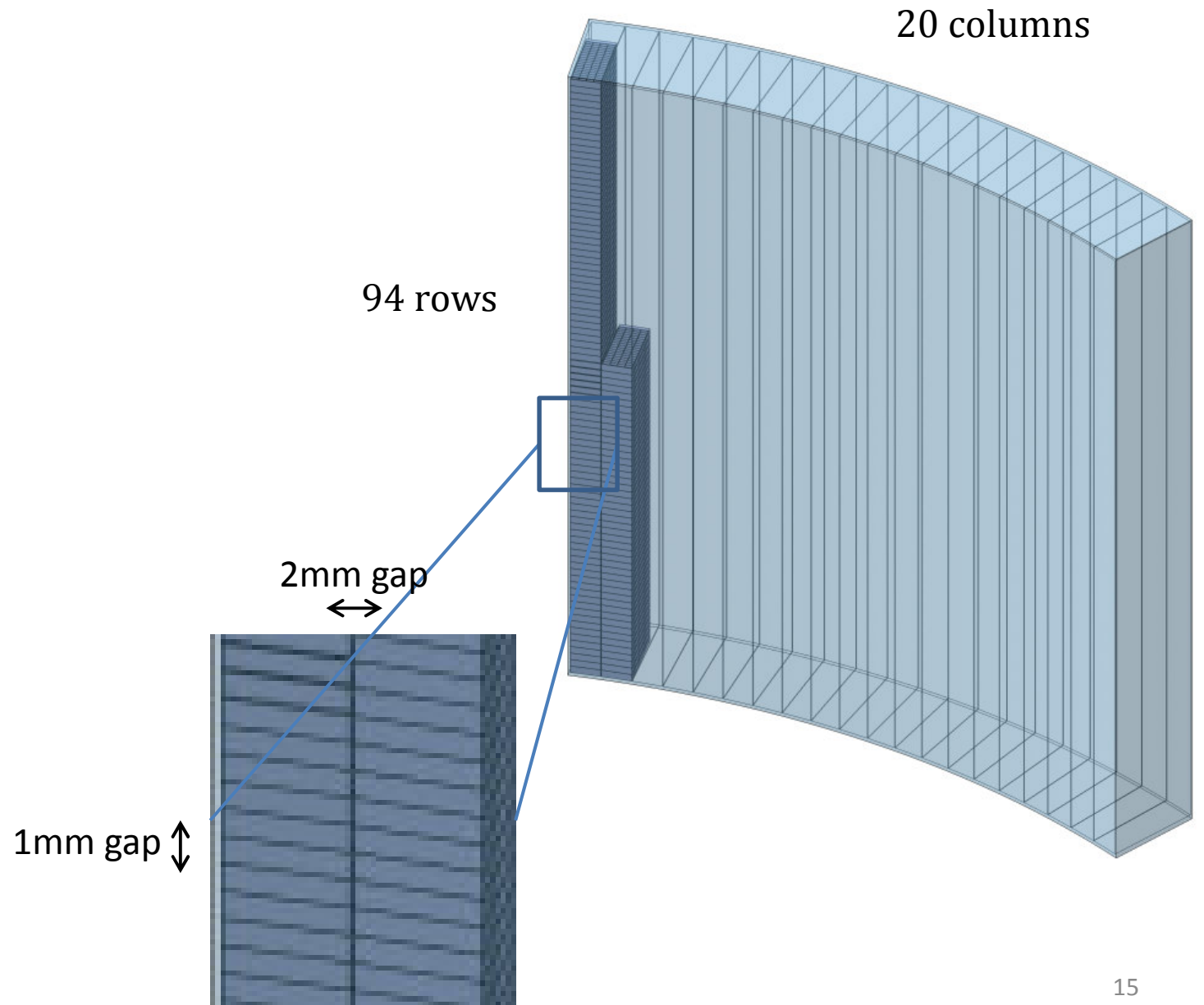
COST



# MG preliminary integration concept



# MG preliminary integration concept



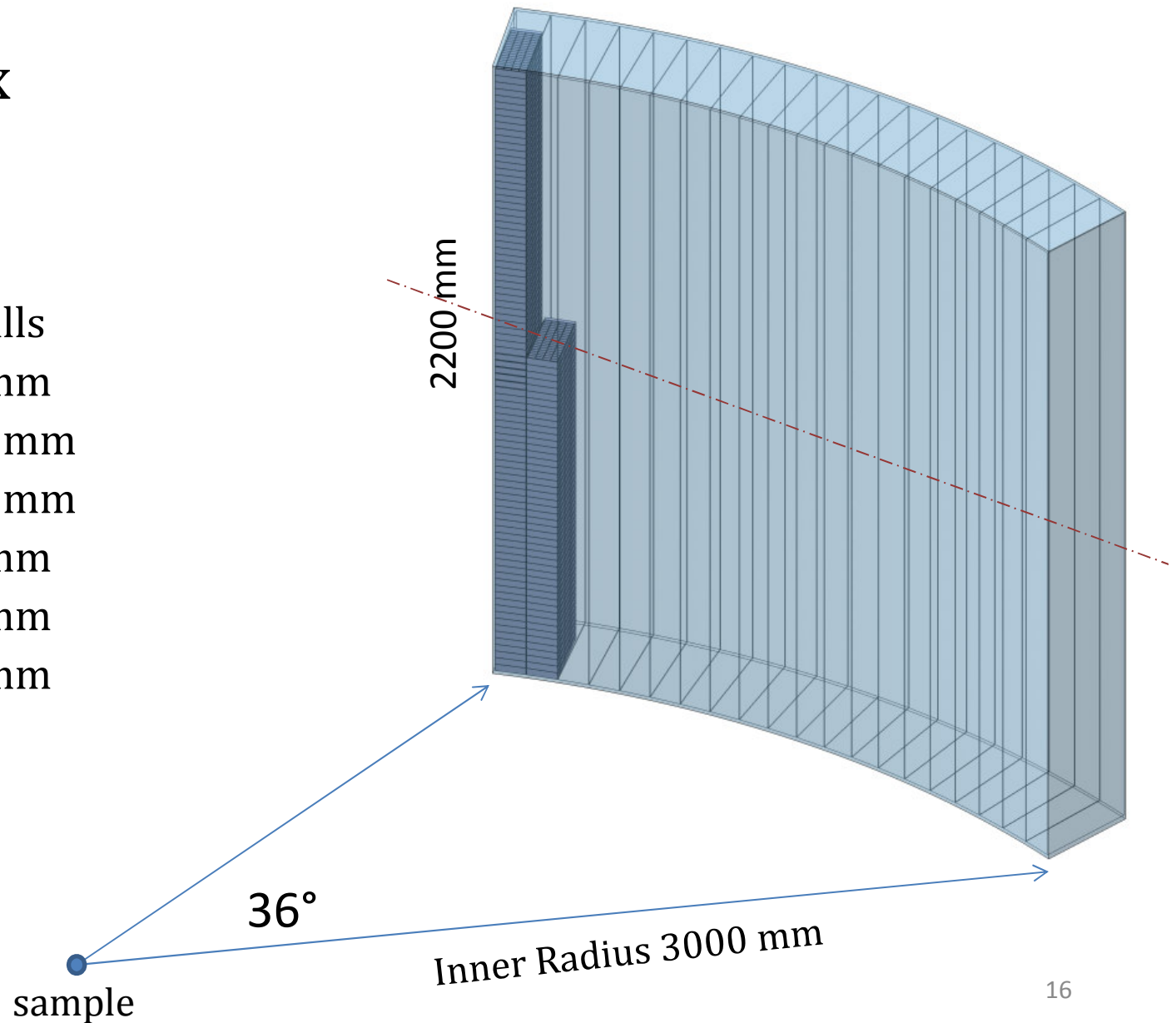
# MG preliminary integration concept

## Detector – Box

AlMg4.5Mn

### Thickness of the Walls

- Sides 7 mm
- Top 10 mm
- Bottom 10 mm
- Back 5 mm
- Front 2 mm
- Ribs 2 mm

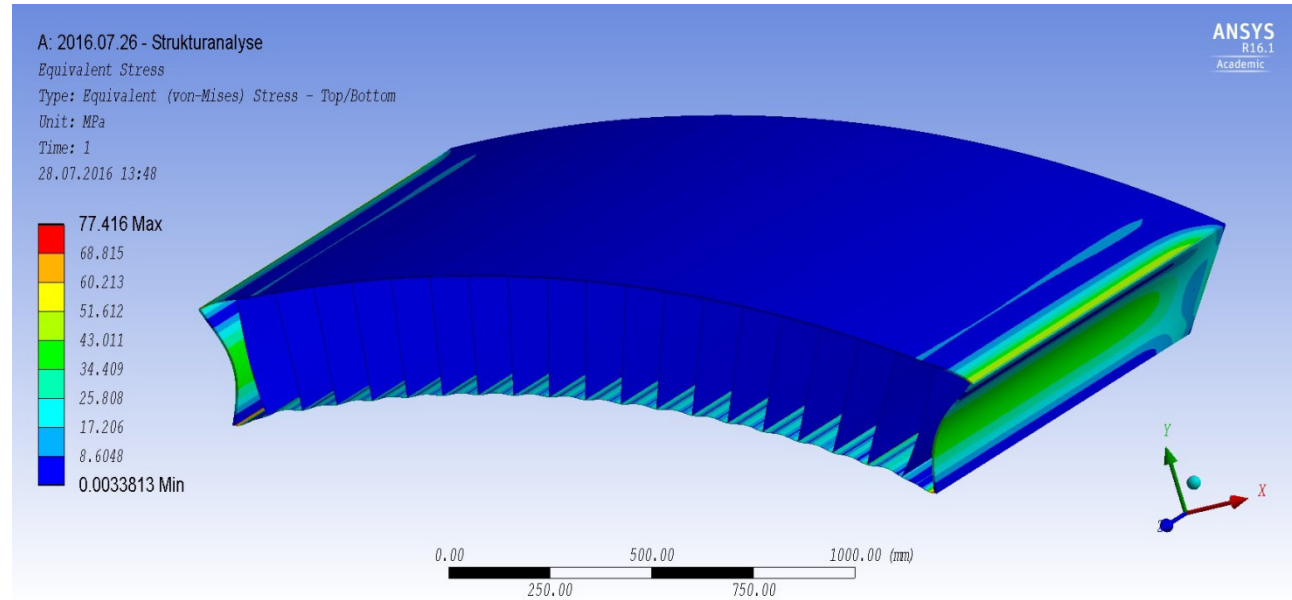




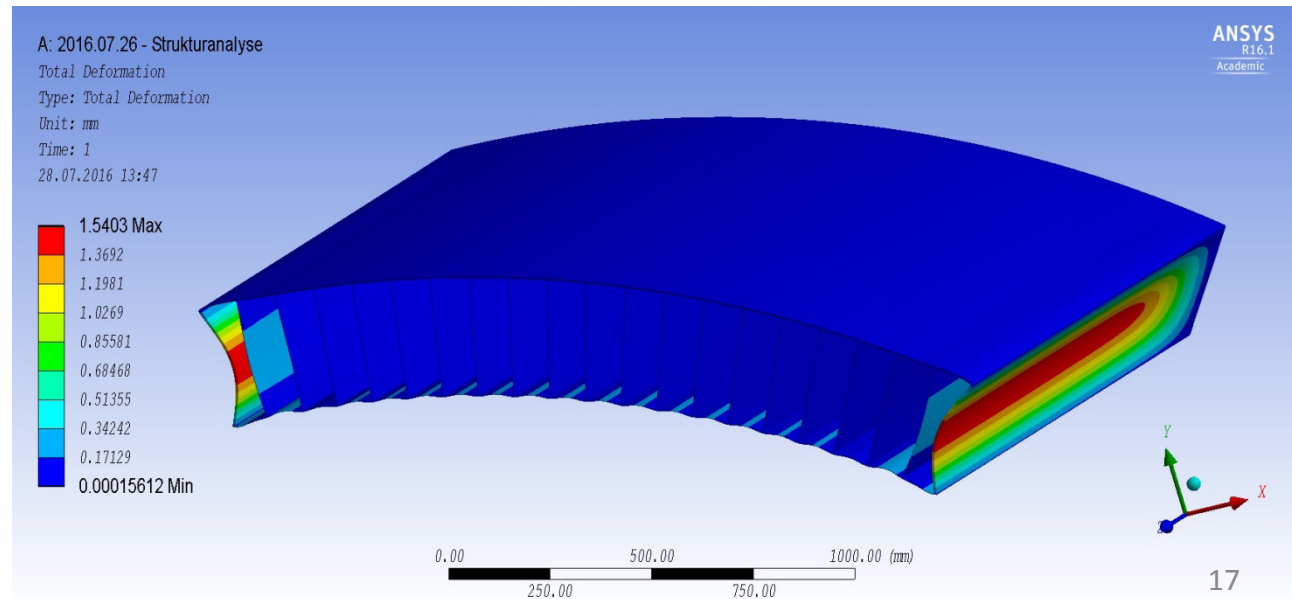
# MG preliminary integration concept

Pressure  
500 mbar

Stress  
< 75N/mm<sup>2</sup>



Deformation  
< 1.5 mm



# MG preliminary integration concept

5 boxes

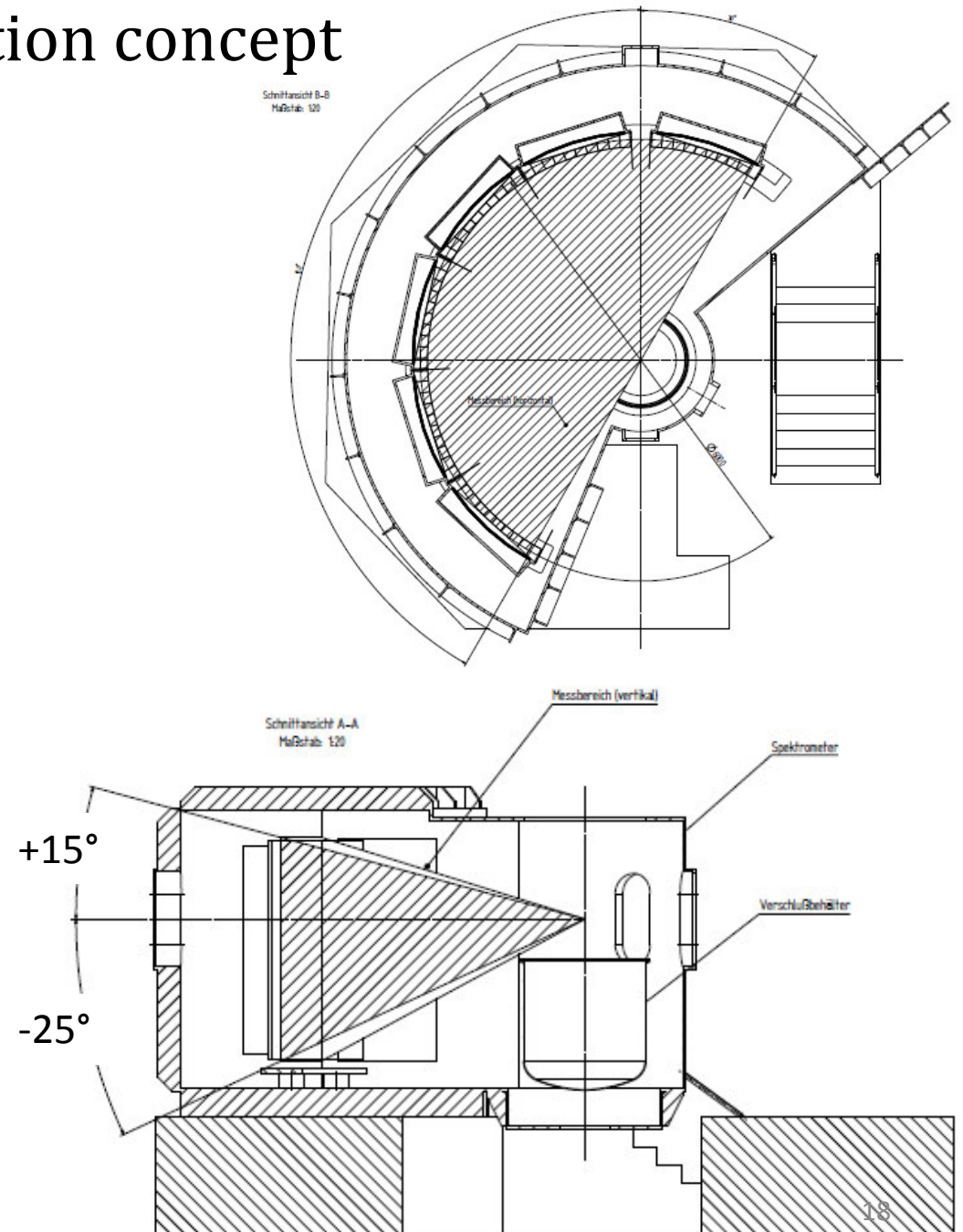
4 gaps with pixel-equivalent dimension

Vacuum compatibility

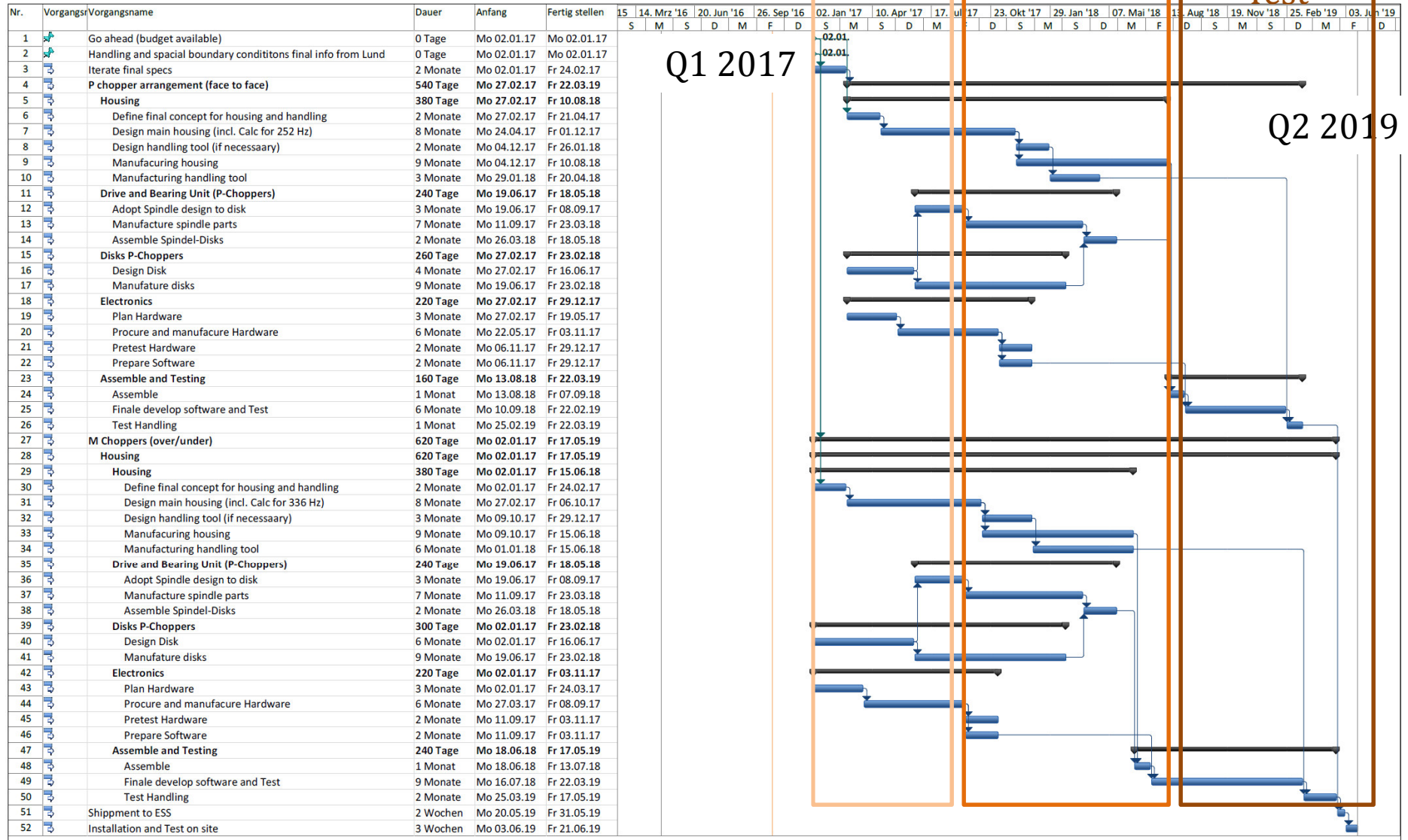
Easy maintenance philosophy

Easy access to electronics box

Expected cost is 100k€



# Timeline Choppers

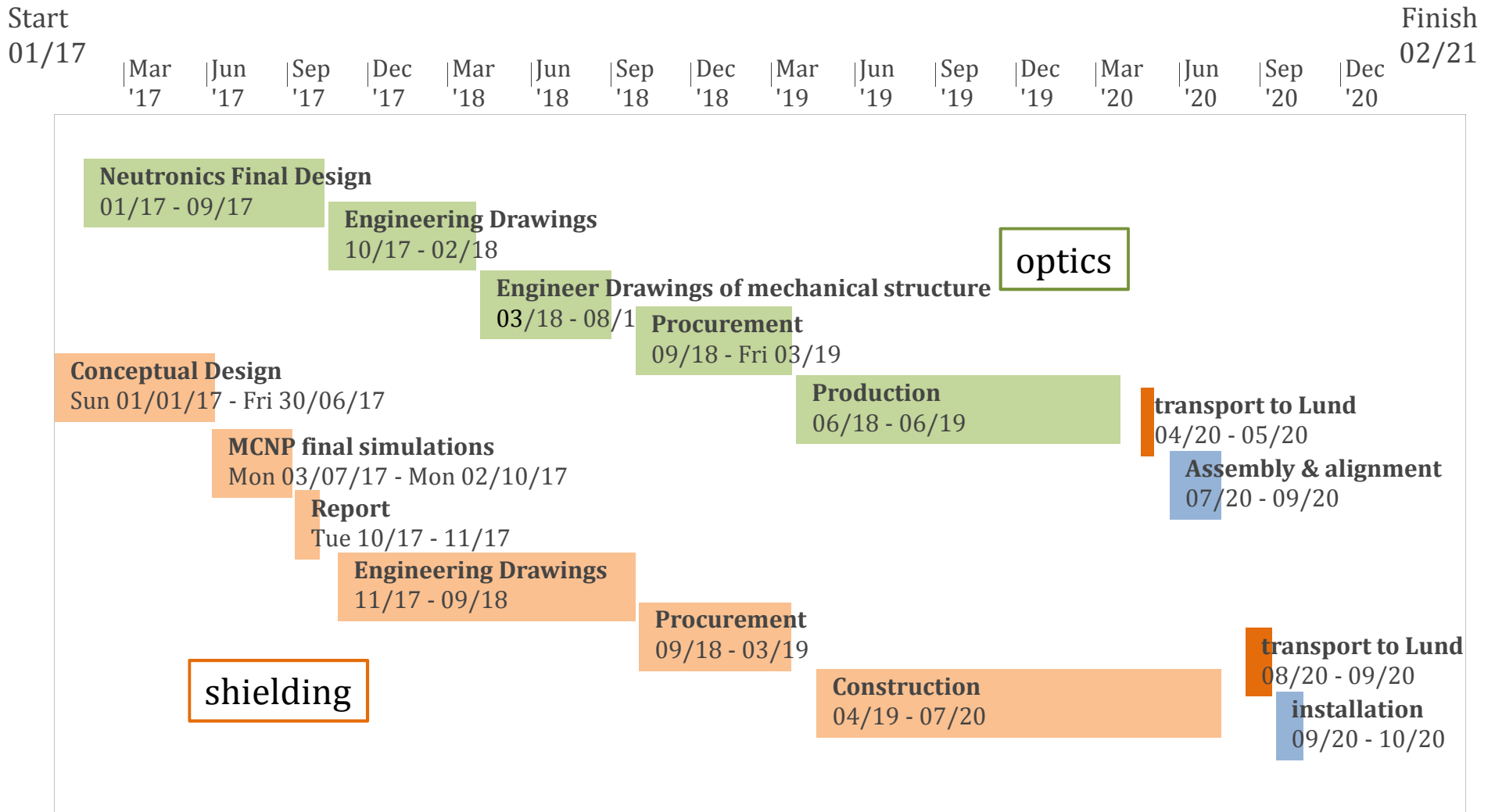


Q1 2017

Design Construction Assembling Test

Q2 2019

# Timeline Optics and Shielding



# Cost Category C

“ESS management defined a preliminary budget of 15 M€ for this instrument project “

10 % contingency

Allocated budget : 13.5 M€

Labor Value 3.7 M€

Components share : 9.8 M€

